FELINE AORTIC THROMBOEMBOLISM: PREVENTION AND NOVEL ACUTE MANAGEMENT APPROACHES

Universitat Autònoma de Barcelona

Sara Evangelista González

Final Degree Project – June 2020

Facultat de Veterinària

BACKGROUND

- ATE is more common in cats than any other species, comprising 79-85% of their arterial thromboembolism cases.
- Survival rates are low, ranging from 14-40% when there is a bilateral pelvic limb infarction.
- CMs account for 90% of ATE cases, especially HCM.
- 5-21% of cats with HCM suffer from ATE.

Abbreviations: ATE = aortic thromboembolism; CM = cardiomyopathy; HCM = hypertrophic cardiomyopathy; LAD = left atrial dilation; LAA = left atrial appendage; LMWHs = low molecular weight heparins; NOACs = new oral anticoagulants; UFHs = unfractionated heparins.

OBJECTIVES

- To perform a review on the state of the art of ATE's acute management and preventive approaches.
- Analyse the effectiveness of the current standard of care and the available alternatives.

POOR PROGNOSIS

- Hypothermia
- Multiple affected limbs
- Loss of motor function

PATOPHYSIOLOGY

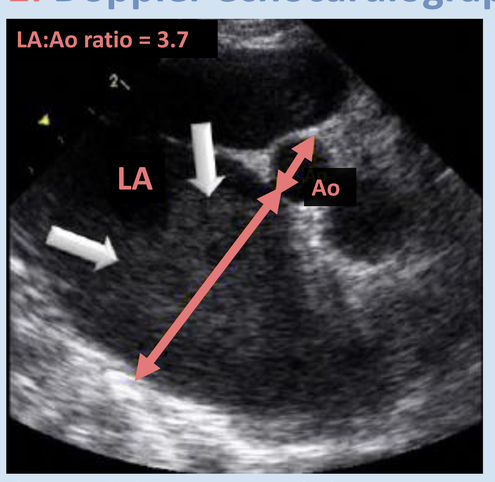
CM causes left diastolic dysfunction → (Virchow's triad: LAD) → Cardiogenic thrombosis in the LAA → Embolisation → Lodging in the aortic trifurcation

- **Bilateral pelvic limb infarction** (60-71% of cases)
- **Ischaemic neuromyopathy** of the limbs

Activated platelets → Vasoconstriction of collateral blood flow

PREVENTION

1. Doppler echocardiography to define risk:



Moderate to severe LAD:

- LA:Ao > 1.9-2
- LA diameter > 17-20 mm

Blood flow velocities <0.20 m/s in the LAA.

Spontaneous echocontrast (SEC) or intracardiac thrombus

+/- Previous history of ATE

Figure: Right parasternal short-axis view of a cat with restrictive CM and severe LAD and SEC (white arrows). LA (Left atrium); Ao (Aorta) (Chetboul et al. 2019) [Modified].

2. Criteria for treatment application

Moderate risk	High risk
CMs Hyperthyroidism Pulmonary neoplasia **OR** LAD, SEC, low blood flow in the LAA	Predisposing disease + risk factor/s
Recommendation	**Indication**

OBJECTIVE
Postpone ATE onset or recurrence

3. Thromboprophylactic treatment

ANTICOAGULANTS +

LMWHs (enoxaparin/dalteparin):

- Subcutaneous administration

NOACs (rivaroxaban/apixaban):

- Oral administration
- Requires further studies in cats

ANTIPLATELET AGENTS

Clopidogrel:

- Oral administration
- Proved to reduce ATE recurrence and cardiac death.

ACUTE MANAGEMENT

Antithrombotic therapy: current standard of care

- Induction of a hypocoagulable state: UFHs
  prevents further embolus growth and microcirculation thrombosis.
- Improvement of collateral blood flow: clopidogrel (75 mg)
  avoids the release of vasoactive substances.

OUTCOME: survival rates of 31-45% in cats with arterial thromboembolism.

→ **Sufficient** in cats with a **single limb infarcted**.

→ **Insufficient** in cats with **≥ 2 limbs infarcted**.

→ **Euthanasia at presentation** in 25-61% of patients.

→ **Same risk of reperfusion syndrome** as infarction resolution.

Acute thrombus resolution: not common practice

Thromboembolus interventionism

- Surgical thromboembolectomy: through aortotomy.
- Rheolytic thromboembolectomy: through percutaneous aspiration.

→ Treatment of choice in humans with ATE.

→ Counted cases in cats, but successful.

Systemic thrombolysis - Tissue Plasminogen Activator

→ Marginally superior to antithrombotic therapy.

→ Survival notably increases in high-dose protocols (77.8%).

→ Cost may preclude its use.

Blood flow resumption → **Reperfusion syndrome** → First cause of mortality

Treatment must be attempted in **<4 hours since ATE onset** + **Adjuvant antithrombotic therapy**

Severity

- Duration of ischaemia
- Extension of ischaemia

- CONCLUSIONS -

- ✓ The detection of LAD, SEC and low blood flow velocities in the LAA can successfully predict ATE risk.
- ✓ The protocolisation of Doppler echocardiography in target patients and thromboprophylaxis prescription may significantly reduce ATE onset.
- ✓ Acute thrombus resolution techniques seem promising for cats with multiple limb infarction since they do not respond to antithrombotics.
- ✓ Early intervention of thrombus is crucial for survival, and its implementation in protocols could reduce euthanasia rates at presentation.
- ✓ Further studies are required to confirm the best multimodal thromboprophylactic therapy upon NOACs' normalisation and to evaluate the outcome of thrombus resolution techniques once refined and protocolised.